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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/929,765	08/14/2001	Chih Chin Liao	56370	9374
21874	7590	08/09/2005	EXAMINER	
EDWARDS & ANGELL, LLP			WARREN, MATTHEW E	
P.O. BOX 55874			ART UNIT	
BOSTON, MA 02205			PAPER NUMBER	
			2815	

DATE MAILED: 08/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 09/929,765	Applicant(s) LIAO, CHIH CHIN	
	Examiner Matthew E. Warren	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 6,8,11,13 and 14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 6,8,11,13 and 14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____.  |

### DETAILED ACTION

This Office Action is in response to the Amendment filed on May 24, 2005.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Applicant's Prior Art Figures 3 and 4 (APAF) in view of Takahama (JP 6-157238).

In re claim 6, the APAF 3 and 4 shows a BGA package a substrate 10 having a front and back side, a chip 20 mounted on the front side of the substrate, the chip having an array of bond pads 30B, an array of solder balls 40A on the back side of the substrate, and an array of bond fingers 60B beside the chip and electrically connected to the bond pads of that chip by a plurality of first bonding wires (50B). An array of electrically conductive vias (72 & 74) penetrate from the front to the back side of the substrate and connect to the solder balls. The package also comprises a plurality of continuous electrically-conductive traces (70A-70D) for connecting a first subgroup of the bond fingers to corresponding ones of the vias. The continuous traces including at least one trace interposed between a second subgroup of the bond fingers and their corresponding vias. The APAF shows all of the elements of the claims except the electrically conductive bridge. Takahama shows (fig. 3 and abstract) shows a

semiconductor device having traces (3, 4, and 5) and a conductive bridge (8) in the form of a bond wire spanning in an overhead manner across the traces. The bond wire is free of the interposing traces and has an unfilled gap between the wire and traces. With this configuration, the density of wiring can be increased ultimately increasing the level of integration of the device. When combined with the APAF, the top position of the conductive bridge as a second bonding wire is lower in height than a top position of the first bonding wires. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the connections of the APAF by forming conductive bridges spanning over traces as taught by Takahama to increase the wiring density and ultimately improve the integration of the semiconductor device.

In re claim 14, when the APAF 3 and Takahama are combined the bonding wire of Takahama has one end electrically connected by a first trace to the corresponding via (80A) of the APAF 3, and the other end electrically connected by a second trace to the corresponding bond finger (60B) of the APAF 3.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Prior Art Figures 3 and 4 (APAF) in view of Takahama (JP 6-157238) as applied to claim 6 above, and further in view of Abrams (US 3,560,256).

In re claim 8, the APAF and Takahama show all of the elements of the claims except the bond wire made of gold. Abrams discloses a bridge/crossover that is made of gold wires or includes a resistor (col. 4, lines 3-6, & 25-31) and is free of interference with the electrically conductive trace due to the insulating material (27) between the

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bridge and traces. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the APAF and Takahama by employing gold conductive bridge structures that cross over circuit traces as taught by Abrams to suitably increase the packing density of the circuit.

Claims 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Applicant's Prior Art Figures 3 and 4 (APAF) in view of Takahama (JP 6-157238) and Abrams (US 3,560,256)

In re claims 11 and 13, the APAF 3 and 4 shows a BGA package a substrate 10 having a front and back side, a chip 20 mounted on the front side of the substrate, the chip having an array of bond pads 30B, an array of solder balls 40A on the back side of the substrate, and an array of bond fingers 60B beside the chip and electrically connected to the bond pads of that chip. An array of electrically conductive vias (72 & 74) penetrate from the front to the back side of the substrate and connect to the solder balls. The package also comprises a plurality of continuous electrically-conductive traces (70A-70D) for connecting a first subgroup of the bond fingers to corresponding ones of the vias. The continuous traces including at least one trace interposed between a second subgroup of the bond fingers and their corresponding vias. The APAF shows all of the elements of the claims except the electrically conductive bridge. Takahama shows (fig. 3 and abstract) shows a semiconductor device having traces (3, 4, and 5) and a conductive bridge (8) in the form of a bond wire spanning in an overhead manner across the traces. The bond wire is free of the interposing traces and has an unfilled

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gap between the wire and traces. With this configuration, the density of wiring can be increased ultimately increasing the level of integration of the device. When combined with the APAF, the top position of the conductive bridge as a second bonding wire is lower in height than a top position of the first bonding wires. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the connections of the APAF by forming conductive bridges spanning over traces as taught by Takahama to increase the wiring density and ultimately improve the integration of the semiconductor device.

Neither reference shows that the conductive bridge is a chip resistor. Abrams shows (fig. 1) a circuit in which crossover or conductive bridges are used to increase the packing density of the circuit (col. 2, lines 14-26). The electrically conductive bridge 26 spans in an overhead manner across interposing traces (22c & 22d) and connect one end of a trace 22b to the end of another trace 22a. There is a gap between the bridge and the interposing trace (that gap is filled with an insulating material). The bridge/crossover is made of gold wires or includes a resistor (col. 4, lines 3-6, & 25-31) and is free of interference with the electrically conductive trace due to the insulating material (27) between the bridge and traces. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the APAF and Takahama by employing conductive bridge structures such as chip resistors that cross over circuit traces as taught by Abrams to also increase the packing density of the circuit.

***Response to Arguments***

Applicant's arguments filed with respect to claims 6, 8, 11, 13, and 14 have been fully considered but they are not persuasive. The applicant primarily asserts that the cited references of the APAF, Takahama, and Abrams do not show the amended limitations of a top position of the electrically conductive bridge being lower in height than a top position of the first bonding wires. As stated in the rejection above, when Takahama is combined with the APAF 3 and 4, the top position of the bridge of Takahama will be lower than the top position of the first bonding wires shown in the APAF. There is nothing in Takahama or Abrams that would indicate that the conductive bridges would have high profile. In fact, an air bridge would naturally have a lower profile or height due to the way it spans efficiently over the substrate and lower conductive traces. The conductive bridge (7) shown in figure 2 of Takahama has a low profile and would not exceed the height of the bond wires shown in the APAF. Furthermore, although the drawings show that the bridge is lower than the bond wires, the applicant's specification (top paragraph of page 2) states that the drawings are not drawn to scale. Therefore, the drawings cannot be solely relied upon to teach such a feature. The specification itself does not specifically state that the bridge is lower than the height of the bond wire and thus does prove the criticality of that feature. Thus the limitation in question is not distinguishable over the cited art for those reasons and the APAF combined with Takahama already teach the invention. Therefore the prior art shows all of the elements of the claims and this action is made final.

***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (571) 272-1737. The examiner can normally be reached on Mon-Thur and alternating Fri 9:00-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.




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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MEW

August 3, 2005

  
TOM THOMAS  
SUPERVISORY PATENT EXAMINER